LEGO® Education
Computer Science Learning Progression

SPIKE™ Essential Grade 3

Introduction

LEGO® Education believes that students learn best through play—by actively doing, exploring, and experimenting. This approach empowers them to become creative and engaged lifelong learners, which is essential for success in their future careers and lives.

Read this Introduction to explore ways to use this learning progression and find activities that support your learners.

This learning progression organizes activities in a recommended sequence that supports students' successful learning with LEGO® Education SPIKE™ Essential. For classroom convenience, it also clusters activities that use the same model.

Following the recommended sequence ensures that students build the necessary knowledge and experience for each successive activity. However, you may also choose activities according to your students' needs and prior knowledge/experience.

Some activities are reprinted or modified from published LEGO Education sources. Others are developed especially for these learning progressions.

Each activity

- ☑ contains anticipated timing, topics, relevant standards, learning objectives, and a ready-to-use prompt.
- ☑ is labeled with one or more topics, such as Modifying Programs (computer science) or Narrative Writing (ELA).
- ☑ lists the relevant standards, beginning with the most important standard in the learning.

To find what you need,

- ☑ scan the Topic(s) & Standards column or search with terms like *CSTA*, *ELA*, or *Math*.
- ☑ use the **Key** below to locate activities of different lengths and levels of instructional support.
- ☑ use the **Additional Resources** below to locate more support.

Key

1 Numbers show the recommended order in which to use activities.

Activities that will take approximately 20–30 mins

LESSON Longer activities with full lesson support

PROMPT Short activities to quickly expand or extend the learning

Activities that use only bricks and require no hardware/software

or Activities that will take approximately 45 or 90 mins

MORE DETAILS Links that lead to lesson details and teaching support

Additional Resources on the LEGO® Education Community

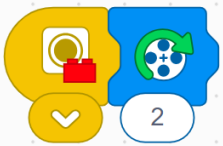
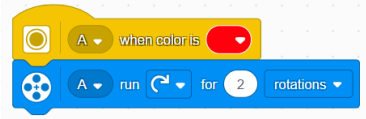
- ☑ *SPIKE™ App Help* Definitions and directions for using the coding blocks located in the HELP section of the LEGO® Education SPIKE™ App
- ☑ *Curriculum Integration Guide* SPIKE Essential activities organized by domain Also contains a protocol for integrating activities into your curriculum
- ☑ *Coding Blocks in LEGO® Education SPIKE™ Essential Lessons*
- ☑ *Basic Coding Concepts in LEGO® Education SPIKE™ Essential Lessons*
- ☑ *Troubleshooting with LEGO® Education SPIKE™ Essential*
- ☑ *Computational Thinking in LEGO® Education SPIKE™ Essential Lessons*

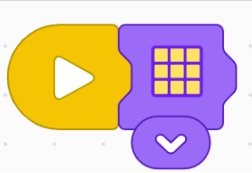
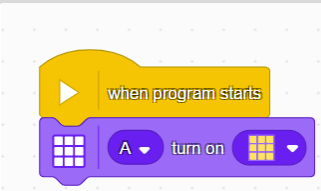
#	Activity Name	Topic(s) and Standards	Objectives Students will	Prompt
1	PROMPT **Tallest Tower**	**Sequences** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **Speaking and Listening** **CCSS.ELA-Literacy.SL.3.1** Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion). **Skill Practice: Sequence of Events**	• Investigate what makes a sequence by practicing following step-by-step instructions. • Understand the importance of clear steps and directions. • Follow agreed-upon rules for collaborative work.	Use a simple follow-the-steps activity to introduce students to sequencing and the importance of working collaboratively. Organize pairs and provide each with the same bricks. Allow 5 minutes for pairs to build the possible tallest tower. Repeat with a second tower, only students take turns adding to the tower and may **not** talk to each other. Lead discussion about why the second task is harder. If you wish, have students exchange verbal building directions. **Say/Ask** *With your partner, build the tallest tower you can in 5 minutes. Now build another tower. Take turns adding to it. But don't talk to each other! What was the difference? Why?* ***Then try this>*** *Give your partner step-by-step building directions to create a tower.*
2	PROMPT **Meet New Blocks**	**Software Systems** **CSTA 1B-CS-02** Model how computer hardware and software work together as a system to accomplish tasks. **Reading Informational Texts** **CCSS.ELA-Literacy.RI.3.9** Compare and contrast the most important points and key details presented in two texts on the same topic.	• Compare word and icon blocks to find the ones that do similar coding functions. • Explain how different software grammars can achieve the same result.	Introduce word coding blocks. From the LEGO® Education SPIKE™ App Help section, display some images of icon blocks and discuss what they do. Then display some word blocks and name some blocks that are similar. Prompt discussion. If you wish, focus the comparison on one category of blocks, such as motor blocks. Use the provided questions or others you like. **Say/Ask** *We're going to learn some new ways to code. If you've used icon blocks, you know some of these blocks. Now let's look at word blocks. What do you notice?* (There are many more.) *Let's look at the Motor Blocks section. Which word block would allow you to change directions or change the speed of a motor? What else could you do with the motor in word blocks that you can't do in icon blocks?* **More Details** 1) *Motor Blocks* in the Help section of the SPIKE App, available on the web or downloaded. 2) *Coding Blocks in LEGO® Education SPIKETM Essential Lessons* (Units 1–2 use icon blocks; Units 3–5 use word blocks.) 3)

3	**PROMPT** **Meet the Motor and New Motor Blocks** 	**TESTING, COMPUTATIONAL PROBLEMS** **CSTA 1B-AP-08** Compare and refine multiple algorithms for the same task and determine which is the most appropriate. **TROUBLESHOOTING STRATEGIES** **CSTA 1B-CS-03** Determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies.	• Follow instructions to create a program. • Compare programs using two different block languages to turn a motor. • Describe coding steps in sequence.	1. Introduce students to the motor in their set as they prepare to program it. 2. Using the Motor tutorial, have students start the motor. Then prompt them to describe the coding steps in words to a partner. 3. When students have completed the motor tutorial with icon blocks, have students click on tutorial 5 Word Blocks. 4. Have students discuss the similarities and difference in using the icon blocks to control the motor and the word blocks. **SAY** *Connect a small motor to your hub. Follow the tutorial steps to make it move. Then tell your partner step by step what the code does. Say what happens in order.* *Next, complete the word block tutorial and program the motor using word blocks. Discuss similarities and differences between the icon blocks and word blocks with your partner.* *Discuss strategies for troubleshooting hardware and software (e.g. low battery, Bluetooth disabled, hardware not connected properly).* **MORE DETAILS** *Motor Blocks* in the Help section of the LEGO® Education SPIKE™ App, available on the web or downloaded.

4	**PROMPT** **More with Word Blocks** 	**CONTROL** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals.	• Describe the function of different block types. • Explore different ways to program a motor using word blocks. • Use appropriate terminology when using hardware and software.	1. Have students begin lesson using word block tutorial with one motor. **SAY** *Let's learn more about word block coding. Use the Motor Blocks that we learned about to program your motor to move in different ways. To start, program the motor to change directions and speed. Then see what else you can do.* 2. *Share with students the technical names for the word blocks.* **SAY** *The word block "when program starts" is an event. When we use word blocks, events are all Hat Blocks (have the curved top so you can only stack blocks underneath). Hat Blocks are necessary to start a programming stack and are triggered when an event occurs.* *Stack Blocks are used for different commands in a program, in this case to turn a motor in a certain direction or with a specific power level. The notch on the top of the block and on the bottom of the block allow the blocks to be stacked together.* **MORE DETAILS** *Word Blocks* tutorial in the START section of the SPIKE App, available on the web or downloaded.

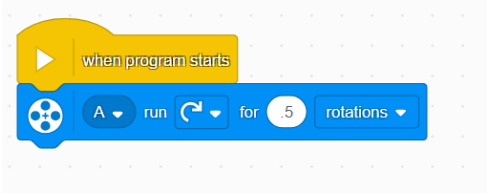
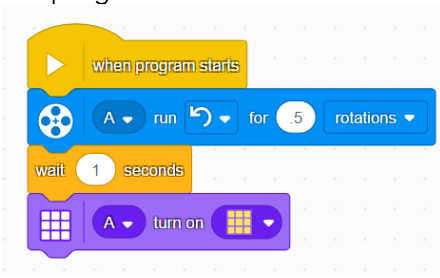
5	**PROMPT** **Dancing Robot** 	**COLLABORATING AROUND COMPUTING** **CSAT 1B-AP-16** Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development. **SEQUENCES** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals.	• Follow instructions to create a program. • Explore programming a motor. • Use appropriate terminology when using hardware and software.	1. Discuss with students how to share roles when working with a partner when programming. What responsibilities could each member have during the activity? (e.g. "driver" of the computer, builder, parts manager, program developer, note taker, tester). 2. List roles on the board and talk about what each role would involve and when the role might be needed within the project. 3. For programming, have one student be a program developer (explain what programming blocks are needed and the order) and the second student be the driver of the computer (build the program on the computer). Students can switch roles during the lesson. 4. Using the word block tutorial, extend the activity to create a dancing robot. **SAY** *Connect an axle to your motor. Build a small robot on the axle. Then connect the motor to the hub and program the motor to make the robot dance.* ***Then try this>*** *Now program the motor to move to the beat, playing slow and then faster music. Be sure to switch roles.* **NOTE** Try using roles for each lesson and activity. **MORE DETAILS** *Coding Blocks in LEGO® Education SPIKE™ Essential Lessons*

6	**PROMPT** **Meet the Color Sensor** 	**SEQUENCES** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **TESTING, COMPUTATIONAL PROBLEMS** **CSTA 1B-AP-08** Compare and refine multiple algorithms for the same task and determine which is the most appropriate.	• Create a simple pseudocode to describe the steps needed in a program. • Use pseudocode to create a program to complete a task. • Use appropriate terminology when using hardware and software.	1. Introduce the Color Sensor with the tutorial in the App. Once students have the motor moving with the Color Sensor, prompt them to describe what each coding step does. 2. Introduce students to pseudocode. **SAY** *Pseudocode is the description of steps needed to complete a programming task written in everyday language. How can we describe the steps in this program using pseudocode?* When the color sensor detects red Run the motor clockwise for 2 rotations.  **SAY** *Now that we have our pseudocode, or steps needed, let's try to program the color sensor using word blocks.* Challenge students to create a program using the pseudocode in word blocks. Have students test their programs. What was similar and what is different in the programming languages? When the color sensor detects red Run the motor clockwise for 2 rotations.  **Note:** Students will need to navigate back to the home screen of the SPIKE App by clicking on the House Icon and selecting a new program using word blocks. The entire palette of programming blocks will appear. You could take the time at this point to share how blocks are organized and review the purpose of an event as well as hat blocks and stacking blocks. **MORE DETAILS** *The Color Sensor* tutorial in the START section of the LEGO® Education SPIKE™ App, available on the web or downloaded.

7	**PROMPT** **Meet the Light Matrix**	**SEQUENCES** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **TESTING, COMPUTATIONAL PROBLEMS** **CSTA 1B-AP-08** Compare and refine multiple algorithms for the same task and determine which is the most appropriate.	• Investigate the Light Matrix. • Use word blocks to create sequences using the Light Matrix. • Use appropriate terminology when using hardware and software.	1. Introduce the Light Matrix as students program it to show light patterns. Invite them to share their work. **SAY** *The SPIKE team wants to use the Light Matrix in their adventures. Plug the Light Matrix into the hub and try programming it with word blocks to make light patterns. Show your patterns to other groups.* 2. Review the term pseudocode with students (the description of steps needed to complete a programming task written in everyday language) 3. Challenge students to write pseudocode for the icon block program they created. **SAY** *Let's write a description of the steps we needed to make the light block turn on the yellow lights. Remember we call this description pseudocode.* When play is pressed The Light Block will play and turn all the lights yellow.  4. Challenge students to create a program using the pseudocode in word blocks. Have students test their programs. What was similar and what is different in the programming languages? When play is pressed The Light Block will play and turn all the lights yellow.  **Note:** Students will need to navigate back to the home screen of the SPIKE App by clicking on the House Icon and selecting

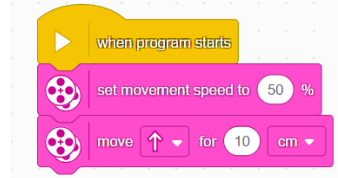
				a new program using word blocks. The entire palette of programming blocks will appear. You could take the time at this point to share how blocks are organized and review the purpose of an event as well as hat blocks and stacking blocks. **MORE DETAILS** *The Light Matrix* tutorial in the START section of the SPIKE App, available on the web or downloaded.
8 L	**MEET THE TEAM**	**SEQUENCES** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals.	• Design and program a model to represent an idea.	1. As a class, read the bios for Maria, Daniel, Sofie, and Leo. 2. Ask students to think about a team mascot. What kind of mascot would they have? What would the mascot's name be? Brainstorm ideas. 3. Have students build a model of their mascot using the motor from SPIKE essential and other bricks in the set. Have students use the program from the motor tutorial to make their motors move. Students can add the color sensor or the light matrix as well as sound. 4. Have students share their build with another pair, explaining the team mascot they selected for the SPIKE Essential minifigure team.

	**River Ferry**			
#	**Activity Name**	**Topic(s) & Standards**	**Objectives** Students will	**Prompt**
9 🕒🕒	**Lesson**	**Computational Thinking** **CSTA 3–5 1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. **Design Engineering** **NGSS 3-5 ETS 1-1** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	• Develop a sequence to solve a problem. • Decompose problems into smaller parts.	1. Use the *River Ferry* lesson to introduce decomposing problems into smaller sub-problems, a key skill in both programming and engineering design because it helps clarify the problem, focus on elements of it to solve, and identify constraints or criteria for success. **Say** *Help Daniel create a program using the motor to move the ferry. That way he can reach the Spike Tower.* **More Details** *River Ferry lesson* or access in the LEGO® Education SPIKE™ App.
10 🕒	**Prompt** **More with CS**	**Sequences** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **Speaking and Listening** **CCSS.ELA-Literacy.SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.	• Develop a sequence to solve a problem. • Decompose problems into smaller parts. • Recount an experience using relevant facts and descriptive detail. • Use the Light Matrix to send information to Daniel.	1. Extend students' use of the Light Matrix by programming it to send signals for Daniel. To include the added background prompt, model how to add the Display Extension in the LEGO® Education SPIKE™ App (New project>Word blocks>  + at far left to open extensions menu>Choose Display). Then refer students to the Display blocks in the Help section in the App to program backgrounds. **Say** *Add the Light Matrix to the River Ferry model. Program it to show a green light when Daniel can safely leave the Ferry.* ***Then try this>*** *If you like, add a background to your program to show when Daniel arrives.* **More Details** *The Light Matrix* tutorial in the START section; *Display Blocks* in the Help section of the SPIKE App, available on the web or downloaded.

11	**PROMPT** **Debugging**	**TESTING** **CSTA 1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.	• Identify and fix errors in a program (test and debug).	1. Remind students that debugging is a method for finding and fixing mistakes in a program if it doesn't produce the desired results. 2. Have students build the model for River Ferry to test the debugging programs. 3. Share the following code with students:  **SAY** *Daniel is working a program for the river ferry. He wants the motor of the river ferry to have 20 percent power and then turn counterclockwise for half of a rotation. The program isn't working as is should. Can you run the program and then find and fix the bugs?* 4. Then challenge students with another program to debug. Share the following code with students and have them use the River Ferry Model to help debug the program.  **SAY** *Daniel wants a light to display blue for 2 seconds, then wait a second before the motor turns and launches the boat. When he runs the program, it is not working the way he wants it to. Can you find the bugs and fix the program?*

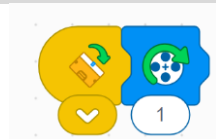
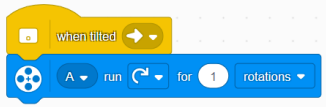
#	Activity Name	Topic(s) & Standards	Objectives Students will	Prompt
12 (L)	PROMPT **Integrated CS and ELA** **Character Traits**	**SEQUENCES** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **READING LITERATURE** **CCSS.ELA-Literacy.RL.3.3** Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events. **DESIGN ENGINEERING** **NGSS 3-5 ETS 1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	• Design, build and program a model that represents a character's feelings within a story. • Describe a story character traits and feelings within a story.	1. Have student pairs identify a character from a story they're currently reading. 2. Prompt them to design a model that represents the character's traits and feelings they have during a specific part of the story. **SAY** *Leo and Maria love to tell stories. When they tell a story they like to think about how to help the characters. Think about the story we read. Design and build something that represents how this character might feel during a specific part of the story.*

	**Taxi! Taxi!**			
#	**Activity Name**	**Topic(s) & Standards**	**Objectives** Students will	**Prompt**
13 LESSON	LESSON	**Computational Thinking** **CSTA 3–5 1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. **Speaking and Listening** **CCSS.ELA-Literacy.SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.	• Identify and fix errors in a program (test, debug). • Recount an experience using relevant facts and descriptive details.	1. After building the *Taxi! Taxi!* model, have students generate and modify a program to drive it to the museum and beyond. **Say** *Leo needs help getting to the art museum. Use motor blocks to program the taxi to go to the museum.* ***Then try this>*** *Modify your program to make the taxi take Leo somewhere new. Tell your partner about the new place.* **More Details** *Taxi! Taxi! lesson* or access in the LEGO® Education SPIKE™ App.
14	PROMPT **More with CS** **Count Loop**	**Looping** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals.	• Identify patterns in a program • Use a loop to simplify a program	Extend the Taxi Taxi lesson by introducing the count loop to students. 1. Challenge students to program the taxi to travel along a square shaped road. First have students create the program using only the move blocks. 2. Ask students to look for blocks that repeat in the program. Share with students how you can use a loop block to repeat a series of steps. The count loop will repeat steps a specific number of times. The steps that we want to repeat fit inside this block. The block shape is called a C block and are found in the Control category. 3. Have students modify the program to include the loop block. 4. Challenge students to program the taxi to follow a road that is shaped like a rectangle or other shape using a loop block.

15 🕒	**PROMPT** **More with Math** **Measuring**	**COMPUTATIONAL THINKING** **CSTA 3-5 1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. **MEASUREMENT AND DATA** **CCSS.MATH.Content.3.MD.B.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units-whole numbers, halves, or quarters.	• Test and debug a program to ensure it runs as intended. • Measure distances using a ruler. • Create programs based on measurements.	5. Extend the Taxi Taxi lesson by having students create a map with new places Leo can visit. 6. Provide rulers and prompt students to measure the distance to each place to the half or quarter of an inch. Then have them use their measurements to get code the taxi to reach each place. If desired, connect to the previous ***Then try this.*** **SAY/ASK** *Think about the new places you identified or other places Leo can go besides the art museum. Mark some on a map. How far will Leo travel? Measure the distance to help Leo decide where to go.*
16 🕒	**PROMPT** **More with Math** **Data and Algebraic Thinking**	**DATA AND ANALYSIS** **CSTA 1B-DA-07** Use data to highlight or propose cause and effect relationships, predict outcomes or communicate an idea **OPERATIONS AND ALGEBRAIC THINKING** **CCSS.MATH.CONTENT.3.OA.A.3** Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities e.g. by suing drawings and equations with a symbol for the unknown number to represent the problem.	• Use data to predict an outcome • Solve a word problem involving measurement quantities.	1. Extend the Taxi Taxi lesson to have students predict an outcome based on data. 2. Have students build the Taxi Taxi model 3. On step 9 in the lesson, have students modify the program to the following code: When program starts Set movement speed to 50% Move forward for 10 cm  4. Have students create a starting point for the robot to travel (e.g. a piece of masking tape) 5. Use a stopwatch, have students measure the time it takes for the robot to move 10 cm at 50% power. 6. Have students change the power level to something lower than 50%. Have students predict if it will take more or less time to travel 10 cm. Repeat the process using a value higher than 50%. 7. If time permits, have students estimate how much time they believe it will take the robot to travel 20 cm based on the data collected. Then test their prediction to see if they were correct.

#	Activity Name	Topic(s) & Standards	Objectives Students will	Prompt
17 L L	Rebuild the world LESSON **Racing**	**DEVELOP PROGRAMS** **CSTA 1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. **DIVERSE PERSPECTIVES** **CSTA IB-IC-20** Seek diverse perspectives or the purpose of improving computational artifacts. **FORCES AND MOTION** **NGSS 3-PS2-1** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	• Explore how design affects motion. • Consider how the speed of an object is related to the energy of an object. • Build and iterate on a design for a race car. • Program their race car to move.	1. Have students design, test, and iterate on a next level race car for Aurora. Encourage them to focus on the motion of the race car and discuss how the design could affect speed, for example because of friction or air resistance. If you wish, prompt students to also consider safety at high speeds and designing for sustainability. 2. During the process, ask students to gather and use feedback from classmates to improve the design. 3. Students can use the Taxi Taxi model as inspiration. **SAY** *Design, build, program and iterate on a race car for Aurora. She wants to go fast. But she also wants to stay safe and be sustainable— for example, by not using a lot of tires.* **MORE DETAILS** *Rebuild the World with Racing*
18 L	PROMPT **More with Science and Computer Science** **Force and Motion**	**SEQUENCES** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **FORCES AND MOTION** **NGSS 3-PS2-1** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	• Create a chain reaction with a set of criteria. • Investigate using events to start a reaction. • Determine the best steps/sequence to use in programming a chain reaction.	Leo, Maria, Sofie, and Daniel want to create a chain reaction that will move a ball. 1. Have students use bricks like the links of a chain to represent the steps from the event that starts the reaction to the ball moving at the end. (If you wish, display a chain to show that a chain reaction is a connected series of events. Each event is connected to, and in this case caused by, the previous one.) 2. Have students motorize and program the chain reaction. 3. Discuss the event blocks used and the steps/sequence needed to program the chain reaction. **SAY/ASK** *Help the characters make a chain reaction to move a ball. Build the chain from bricks that stand for the steps needed to make the ball move. Then connect the first brick to a motor. Why is the order of steps important? What event blocks can help you program the chain reaction?*

<table>
<tr><td>  </td><td colspan="4">The Gyro Sensor
MORE DETAILS The Gyro Sensor tutorial in the START section of the LEGO® Education SPIKE™ App, available on the web or downloaded.</td></tr>
<tr><th></th><th>Activity Name</th><th>TOPIC(S) & Standards</th><th>Objectives
Students will</th><th>Prompt</th></tr>
<tr><td>19</td><td>PROMPT
Meet the Gyro Sensor</td><td>SEQUENCES
CSTA 1B-AP-10 Create programs that include sequences, events, loops, and conditionals.

CSTA 1B-AP-08 Compare and refine multiple algorithms for the same task and determine which is the most appropriate.</td><td>• Follow instructions to create a program for the Built-in Gyro sensor.
• Create word block sequences using sensors.</td><td>1. Have students complete the Built-In Gyro sensor tutorial found in START on the SPIKE app.
2. Review the term pseudocode with students.
3. Have students work with their partner to write the pseudocode for the icon block program in the tutorial.
When the hub is tilted right
Turn the motor clockwise
for one rotation
 
4. Challenge students to create the program in word blocks using the pseudocode.
When the hub is tilted right
Turn the motor clockwise
for one rotation
 

5. Have students compare the programs. What is similar and what is different.
6. Next have students connect the Light Matrix to the hub and try programming the Gyro Sensor (using word blocks) to control the Light Matrix so it creates light patterns. As needed, use gestures to clarify tilt and/or have students complete the Built-In Gyro Sensor tutorial. (note, the programming language in the Built-In Gyro Sensor tutorial used icon blocks and a motor)

SAY Practice using the Gyro Sensor that is built into the hub. Connect the Light Matrix to the hub. Write a program with word blocks where the Gyro Sensor makes the Light Matrix create different patterns based on movement of the hub.</td></tr>
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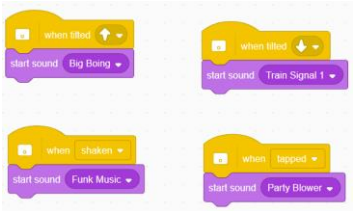
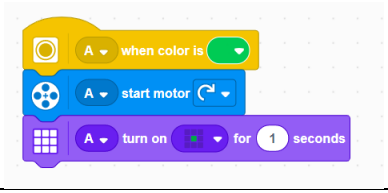
20	**PROMPT** **More with the Gyro Sensor**	**SEQUENCES** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals.	• Create a game that uses sound to get students moving. • Program and iterate the Gyro Sensor to act as the event in a program.	Have students design and program a game for Leo, starting by inventing rules for how to move (hop, skip, twirl, etc.) when a particular sound is played. 1. Have students program some sounds and then program the Built-In Gyro Sensor to control the different sounds based on how it's moved (tilted, shaken, etc.). As needed, show students how to find and use the *When XX* event blocks, so they program the motions.  **SAY/ASK** *Help Leo to invent a game that uses sounds to make you move. Program some sounds and program the Gyro Sensor so different sounds are played as the hub is tilted, shaken, etc. How should listeners move when they hear the sound? Should they hop, skip, twirl, or maybe jump?*

		**Hovering Helicopter**		
#	**Activity Name**	**Topic(s) & Standards**	**Objectives** Students will	**Prompt**
21 L L	**Lesson**	**Develop Programs** **CSTA 1A-AP-17** Describe choices made during program development using code comments, presentations, and demonstrations. **Design Engineering** **NGSS 3-5 ETS 1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	• Describe the choices made when creating a program. • Create and test automated solutions. • Recount an experience using relevant facts and descriptive details.	Have students use programming and the engineering design process to build, program, and test a helicopter for Maria. **Say** *Create, program, and test a helicopter to help Maria get to Spike Mountain for a hike!* **More Details** *Hovering Helicopter* lesson or access in the LEGO® Education SPIKE™ App
22 L	**Prompt** **More with Engineering** **Improving a prototype**	**Develop Programs** **CSTA 1A-AP-17** Describe choices made during program development using code comments, presentations, and demonstrations. **Design Engineering** **NGSS 3-5 ETS 1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	• Remix a program to solve a new problem. • Redesign a model to solve a new problem.	1. Conduct group research on ways that helicopters are used to help people during weather related hazards. 2. Challenge students to modify the helicopter design to help solve a weather-related hazard. Problems might include rescuing, relocating, or delivering items. Have students document the problem they are solving, choices made in terms of the design and code, as well as their solutions.

#	Activity Name	Topic(s) & Standards	Objectives Students will	Prompt
23	PROMPT **Integration CS and ELA**	**CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **Speaking and Listening** **CCSS.ELA-Literacy.SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. **Design Engineering** **NGSS 3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	• Design and build models to represent the beginning, middle, and end of the story. • Practice communication skills through collaborative retellings. • Retell a familiar story with a beginning, middle, and end.	Organize pairs to collaboratively retell a familiar story. Prompt them to build three models—one each to represent the beginning, middle, and end. If time allows, invite pairs to use their models to retell the story to the class. **Say** *With your partner, retell a familiar story. Then build three models, one that shows the beginning, one that shows the middle, and one that shows the end.*

		**Swamp Boat**		
#	**Activity Name**	**Topic(s) & Standards**	**Objectives** Students will	**Prompt**
24 🕒 🕒	**Lesson**	**Modify Programs** **CSTA 1B-AP-12** Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features. **Design Engineering** **NGSS 3-5 ETS 1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	• Identify the parts of an existing program that should be modified. • Carry out tests to identify where a program can be modified. • Recount an experience using relevant facts and descriptive details.	1. After students build the swamp boat, have them create and modify a program to meet Sofie's needs. 2. Recall that she wants to find crocodile eggs, which could be near adult crocodiles. Have students modify the program to find other animals. **Say/Ask** *Sofie found crocodile eggs! Could there be crocodiles nearby? Build a swamp boat so she can find out. Program it to tell Sofie when crocodiles are nearby.* ***Then try this>*** *Change your program to find other animals.* **More Details** *Swamp Boat* lesson or access in the LEGO® Education SPIKE™ App
25 🕒	**Prompt** **More with Math** **Data and graphing**	**Data & Analysis** **CSTA 1A-DA-06** Organize and present collected data visually to highlight relationships and support a claim. **Measurement and Data** **CCSS.MATH.Content.3.MD.B.3** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.	• Use bar graph word blocks to present animal data visually to show relationships between the number of each kind of animal found. • Create a bar graph to show how many of each kind of animal the boat finds.	1. Have students track the number of animals Sofie's boat detects, creating a paper bar graph and using the Bar Graph blocks in the SPIKE App. 2. Prompt them to use their bar graph to calculate and then describe how many more and fewer of each animal the boat encountered. **Say** *Now do some math! Track the number of animals that Sofie's boat finds. Show the information in a bar graph, either on paper or in the SPIKE App. Use your graph to tell how many more or fewer there are of one kind than another.* **More Details** *Coding Blocks in LEGO® Essential SPIKE™ Essential Lessons* or Bar Graph blocks in the Help section of the LEGO® Education SPIKE™ App
26 🕒	**Prompt** **Debugging**	**Computational Thinking** **CSTA 1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.	• Identify the parts of an existing program that should be modified. • Carry out tests to identify where a program can be modified.	1. Provide samples of code that won't help Sofie find the crocodiles. Ask them to debug each code. **Say/Ask** *Why do you think the code isn't working? Study each example to find the problem. Then fix it.* Examples with explanations:

				1) Change the lesson code to show the Color Sensor plugged into the wrong port, e.g., A if plugged into B. (This won't work because the Color Sensor won't get the code.) 2) Add a motor block into the code. (This won't work because the model has no motor.) 

27 🕒	**PROMPT** **Integration CS and ELA**	**CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **READING LITERATURE** **CCSS.ELA-Literacy.RL.3.5** Refer to parts of stories, dramas, and poems when writing or speaking about a text, using terms such as chapter, scene, and stanza; describe how each successive part builds on earlier sections. **SPEAKING AND LISTENING** **CCSS.ELA-Literacy.SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.	• Design and build a scene from a familiar story, including the setting and main events. • Identify and describe a scene from a story, referencing its place in the overall story. • Retell a story, using a model to show descriptive details about setting and events.	1. Ask students to build a scene from a story that the class is reading. Their scene should show • the setting • the major action/events • use motors to add movement where appropriate. • include light block or color sensor, where appropriate. 2. If time allows, invite students to retell the story. **SAY** *Think about the story we read recently. Choose a scene to build. Show what the setting is like. Show the important events that happen in the scene. If those events include movement, connect your motor to make the model move.* ***Then try this>*** *Use the model as you retell the story to us.*

	**Cable Car**			
#	**Activity Name**	**Topic(s) & Standards**	**Objectives** Students will	**Prompt**
28 Lesson		**Sequences** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **Computational Thinking** **CSTA 1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. **Design Engineering** **NGSS 3-5 ETS 1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	• Design, build, and test a model cable car to meet specific needs. • Use sequences and loops to program their models. • Identify and fix errors a program to ensure it works as intended (test and debug).	Have students build, test, and program the cable car model. Then have them explore ways to improve it even more. Review the count loop with students. **Say/Ask** *Leo is nervous about crossing Spike Lake in the cable car today. Can Maria help him conquer his fears? Build, program, and test a cable car for Maria and Leo to ride. Then try to make it work even better!* **More Details** Cable Car lesson or access in the LEGO® Education SPIKE™ App
29 Prompt	**More with Math**	**Sequences** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **Computational Thinking** **CSTA 1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. **Numbers and Operations/Fractions** **CCSS.Math.Content.3.NF.A.1** Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.	• Create simple programs that include specific stops. • Investigate ¼, ½, ¾ fractions.	Prompt students to reprogram the cable car model to stop ¼, ½, and ¾ of the way across the lake. **Say** *Leo had so much fun on the cable car that he wants to continue to ride. Maria wants to try stopping along the way. Program the cable car model to stop halfway (½) through the trip. Then try ¼ of the way and ¾ of the way.*

30	**PROMPT** **More with CS Events**	**SEQUENCES** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **MODIFY PROGRAMS** **CSTA 1B-AP-12** Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.	• Modify an existing program to start with a different event	1. Review Event Blocks with students. Remind students that event blocks are almost always a Hat Block, meaning they are always the first block in a programming stack and other blocks can only be attached under them. Hat Blocks are necessary to start a programming stack and will be triggered when a specified event occurs. 2. Extend the cable car lesson by challenging students to start the program with a different event block. **SAY** *Remember event blocks are used to start a programming stack. Let's look at some of the event blocks we could use to start the cable car. Modify the program to use a different event block. How did using the new event block change the way your program worked?*

	**Big Bus**			
#	**Activity Name**	**Topic(s) & Standards**	**Objectives** Students will	**Prompt**
31	**Prompt** **Unplugged Freeze Game**	**Sequences/Loops/Conditionals** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals.	• Describe a simple conditional statement in a game	Play a game of freeze dancing with students. 1. Explain to students that you are going to play a game. When the music starts, they will start dancing. However, when you show them a green LEGO brick, they need to freeze. When you show them a yellow LEGO brick, they can move again. 2. Explain that in programs, sometimes we want the program to run until something else happens. In programming we call these conditions. For the game you just played, you could write the directions using a condition statement. When the music start, dance. Wait until you see green, then freeze. Wait until you see yellow, then dance. Wait until is a programming block that will pause the program until a condition is true. Explain to student this will be a new block used in the next lesson. 3. Challenge students to work in small groups to make up their own freeze game using LEGO bricks.
31	**Lesson**	**Modify Programs** **CSTA 1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. **Sequences/Loops/Conditionals**	• Improve a program to meet a specific need. • Test and evaluate solutions to determine whether they meet a specific need. • Recount an experience using relevant facts and	1. After students build the big bus model, have them program it to stop for Daniel at the green stop. Then ask them to improve their program to change the bus's route for other stops. 2. Guide them to use a *Wait for* block so the bus stops when picking up riders.

		CSTA 1B-AP-10 Create programs that include sequences, events, loops, and conditionals. **DESIGN ENGINEERING** **NGSS 3-5 ETS 1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. **NGSS 3-5 ETS 1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	descriptive details.	3. Explain this block type to students. The block has a hole in which another block of the same shape can be inserted. These blocks act like conditions. We want the program to wait at this point until the color sensor detects a color, then run the rest of the program. **SAY** *Today is going to be awesome! Help Daniel get to the sports stadium to see the big game. Build and program a bus that stops for Daniel at the green stop. Then add some other stops. Use a* Wait For *control block to make the bus wait for riders to get on.* **MORE DETAILS** *Big Bus* lesson or access in the LEGO® Education SPIKE™ App; *Wait For (Control) blocks* in the Help section of the App.
32 **PROMPT** **Debugging Challenge**		**COMPUTATIONAL THINKING** **CSTA 1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.	• Identify and fix errors a program to ensure it works as intended (test and debug).	1. Remind students that debugging is a method for finding and fixing mistakes in a program if it doesn't produce the desired results. 2. Have students build the model for Big Bus. Then complete the debugging challenge linked below. 2024 Challenge February Debug.pdf (pcomm.net)
33 **PROMPT** **More with Math** **Measurement**		**SEQUENCES/LOOPS/CONDITIONALS** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **NUMBERS AND OPERATIONS/FRACTIONS** **CCSS.MATH.Content.NF.A.1** Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b. **CCSS.MATH.Content.NF.A.3** Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.	• Program a model to stop at a designated spot. • Calculate the total distance a bus travels from a start line through three stops. • Calculate the fraction of the total distance represented by the distance between stops. • Use a model of bus stops to explain the meaning of written fractions, e.g., (¼, ½, ¾).	Have students set three different bus stops 12 inches apart from a start line, and then add the total measurement. Ask them to stop the bus at the different stops and record in a data table how far it drives. Then have students calculate the fraction of the total distance traveled in each distance between stops. Guide students to compare the written fractions (¼, ½, ¾) with the observed position of the bus. This will help them visualize and transfer the meaning of written fractions. Discuss why ½ and 2/4 is the same. **SAY/ASK** *Program the bus to stop three times, each 12" from the start line or the previous stop. What is the total distance that the bus travels? What fraction of that distance represents the distance between each stop?*

34 Accessible Technology Opinion writing	PROMPT **More with ELA and CS**	**ACCESSIBILITY** **CSTA 1B-IC-19** Brainstorm ways to improve the accessibility and usability of technology products for the divers needs and wants of users. **SEQUENCES/LOOPS/CONDITIONALS** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **OPINION/PERSUASIVE WRITING** **CCSS.ELA-Literacy.W.3.1** Write opinion pieces on topics or texts, supporting a point of view with reasons.	• Redesign a model to meet the needs of different users. • Write a persuasive pamphlet telling readers why public spaces should be accessible to all. • Express an opinion and support it with reasons.	1. Engage student in a discussion around the needs of different people who may need to use the bus. 2. Challenge students to redesign and program the bus to meet the need of a different user. 3. Have students write a pamphlet explaining why public spaces (e.g., buildings, buses, schools) should be accessible for all people, including those with a disability. **ASK/SAY** *Why is it important for everyone to be able to use buses or other public places? Write a pamphlet saying what you think. Include your opinion and some reasons for it.*

	**Get Around Town**			
#	**Activity Name**	**TOPIC(S) & Standards**	**Objectives** Students will	**Prompt**
35	LESSON	**COMPUTATIONAL THINKING** **CSTA 3–5 1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. **SEQUENCES/LOOPS/CONDITIONALS** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **DESIGN ENGINEERING** **NGSS 3-5-ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	• Apply computational thinking skills to solve a problem. • Break down the problem to identify what's needed in a strong solution. • Apply engineering design skills to test a solution. • Practice helping a story character. • Describe key ideas or details from a text.	Have students design, build, program, and test a vehicle Daniel, Sofie, Maria, and Leo can use to reach the Spike Castle. **SAY/ASK** *The team is headed to Spike Castle! How can you help them get there? Design, build, program, and test a vehicle that the team can take to the castle.* **MORE DETAILS** *Get Around Town* lesson or access in the LEGO® Education SPIKE™ App

36	**PROMPT** **More with Math** **Data Measurements**	**COMPUTATIONAL THINKING** **CSTA 3–5 1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. **SEQUENCES/LOOPS/CONDITIONALS** **CSTA 1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **MEASUREMENT AND DATA** **CCSS.MATH-Content.3.MD.3** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. **CCSS.MATH-Content.3.MD.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units-whole numbers, halves, or quarters.	• Draw a scaled map of Spike Town that includes three routes to reach Spike Castle. • Measure each route to a ½ or ¼ inch and show this information in a data table. • Use the data table to describe how much specific routes are longer or shorter than others.	1. Have students create a map of Spike Town, including three routes from a starting point of their choice (e.g., school or home) to their destination of Spike Castle. 2. Then prompt them to program their vehicle and practice the routes. Ask which route will be longer or shorter, and then have students measure to a ½ or ¼ inch to confirm or revise their predictions. 3. Finally, have students create a data table with their measurements and use the data to describe how much a given route is longer or shorter than other routes. **ASK/SAY** *What are some different roads the team can take? Make a map of Spike Town and show three different routes to Spike castle. Program your vehicle to try the three routes. Which one seem longer or shorter? Use a ruler to check your thinking, measuring to ½ or ¼ inch. Then show your findings in a data table and use the information to describe which routes are longer or shorter than the others.*